ROOF SHEATHING

Roof sheathing refers to the external layer of a roof, the layer that is in direct contact with the elements and which is the first to be called upon to resist them, assuring that rain water flows away and that infiltrations do not occur. For these reasons, "shingles" have traditionally received greater attention and we look to them for the very technical and mechanical properties that allow them to do their work effectively.
In this section, we consider exclusively sloped roofs constructed with one or more slopes of various pitches. The geometric shape of a pitched roofthat is, of a building's roofed surfaceis defined by one or more inclined surfaces, called slopes. The pitched roof is characterized by such elements as the ridge line, the eaves, the roof ridge, and the roof valley. The pitch of the roof slope depends upon the material used for the sheathing and upon the architecture of the building itself in the context of its urban and natural setting. As a result, we may find slopes of many different lengths and shapes and an enormous variety of pitches, their design dictated by technical as well as morphological considerations, but especially by historical traditions tied to raw materials, to the skill of workers, and to the cultures that characterizedor that characterizethe area in question.

In the sections that follow, we'll describe "bituminous roofing shingles" in greater detailfrom their origins (which go back almost two centuries) to the evolution that Tegola Canadese products represent. We will not neglect application methods along the way, but a more general introduction to roofing materials seems a good way to begin.

Though roofing techniques varied little for centuriesindeed, for millenniathe industrial revolution brought about a series of innovations in this area as well.

Stone Roofing
With the invention of the steam engine, underground-extraction slate-processing techniques were perfected. The decisive turn, as far as stone roofing is concerned, began in 1844 with the ability to produce contoured roofing materials. From then on, stone slabs could be shaped where they were quarried, and improvements in transportation led to the wide use of slate, which came to a culmination with the advent of the First World War.

Fired Brick Roof Sheathing
Fired-brick roofing (masonry tiles), in use for four thousand years, was, at the beginning of the nineteenth century, the most widely used tile material in Europe. Production stages remained well separated (preparation, shaping, firing), which provided an excellent basis for industrial production, first realized with the invention of the tunnel kiln. The tunnel kiln replaced the ring oven (the first industrial technology used) and made continuous combustion both possible and easily manageable, both of which were necessary for industrial production. Later, the production process was completely mechanized and widely automated, and roofing in masonry or fired brick could therefore impose itself on the basis of economic motives as well.

Concrete roof sheathing
The first concrete roofing tiles were produced in Germany around 1844 by a businessman, Adolph Kroher, and were named Staudach Tiles. The production of artificial industrial concrete came later. Notwithstanding their lower cost with respect to the more widely used slate, until 1936 the production of concrete tiles took place largely on a small-scale basis as the result of its strong ties with tradition. Only much later did production begin on an industrial level.

Metal roof sheathing

Metal roof-sheathing materials such as bronze, copper, and lead have been used since ancient times, but it was only beginning in the 1800s that metal roofing materials were employed on a wide scale. The lamination of lead first took place in 1670, followed by copper at the beginning of the 1700s, by zinc in 1805, and by iron in 1818. Sheet iron was widely used as a roofing material only after the introduction of galvanization. Up until that time, painting and recurrent maintenance rendered these types of roofing excessively expensive due to the high risk of corrosion.

Bituminous roof sheathing

Asphalt and pitch were used in ancient Babylonia for the waterproofing of ships as well as in roofing, and were rediscovered during the 1800s. Tar paper, formed of multiple layers of wrapping paper, glued with pitch and tar and finally covered with sand and gravel, was first used on roofs along the Baltic coast at the beginning of the 1800s. Shortly afterward, tar paper was replaced by bituminous paper: roofing with this material made limited slopes possible and facilitated joining techniques. The convenient weight and price of bituminous paper contributed to its widespread use. Roofing in tar and bitumen created the requirements necessary both for the construction of flat roofs, which quickly became fundamental to modern architecture, and for the use of bituminous shingles, which were developed overseas. Keeping the past in mind, we can no doubt say that the modern use of bituminous materials on inclined roofs is based in significant part upon nineteenth-century inventions and that progress has largely been a matter of the automation of manufacturing processes and of improvements in product quality.

Roofing can be classified according to laying methods:

- Discontinuous roofing

  Discontinuous roof covering is composed of a variety of elements which, thanks to the way in which they are installed and to the slope of the laying surface, create a seal against water. Specifically, discontinuous roofing includes:

  - masonry tile roofing
  - concrete tile roofing
  - roofing in fiber concrete sheets
  - roofing in stone slabs
  - roofing in plastic sheets
  - bituminous shingle roofing
  - copper roofing

- Continuous roofing

  Continuous roofing is built with a variety of elements bonded together during installation, in order to effectively seal the roof slope. Continuous roofing includes:

  - cold-waterproofed roofing
  - hot-waterproofed roofing
  - roofing waterproofed with synthetic membranes
  - roofing waterproofed with bituminous membranes
  - roofing in corrugated sheets of galvanized steel, copper, aluminum etc.

BITUMINOUS SHINGLES: A BIT OF HISTORY

The origin of "bituminous shingles" as an industrial product (known in Italian as "Tegola Canadese") goes back to North America during the time of the European migrations. There the colonies, though they were rich in knowledge and in practical experience gained over the centuries in the old continent, had to develop new technologies adapted to the different and extreme environmental conditions they faced on the vast North American continent.

Until the eighteenth century, the production of bituminous shingles was largely the province of artisans. Notable progress occurred in the nineteenth century due, above all, to the industrial revolution and to the development of railroads in North America, which allowed the quick and economical exchange of whatever could be transported (including, obviously, shingles). Increased demand drove the industry to find new approaches and manufacturing methods in order to keep costs as low as possible while simultaneously increasing production and the reliability of their products. As a result, a true bituminous shingle industry was created.

In 1840, in the midst of the Industrial Revolution, a skillful entrepreneur, inspired by the manufacture of cedar shakes which, up to that point had been waterproofed with pine resin, first replaced the resin with a tar produced from the processing of coal, and then the wood with felt and paperboard which were easier to find and to standardize.

This brilliant idea provided a significant spur to the industry. On the one hand, tar was useful because it provided impermeability and resistance over time; on the other, it recycled what was otherwise a waste material.

Later, following a phase of great experimentation, asphalt, a petroleum derivative obtained from natural deposits, began to be used (asphalt corresponds to what we commonly refer to as bitumen). A true boom in the production of bituminous shingles followed during that period, due both to the development of a new technology and to an increase in demand.

Over time, manufacturing methods were refined: the processing of bitumen, the procedure for the waterproofing of shingles, the cutting of individual shingles into standard shapes via a system of cutting rollers, etc.

Tegola Canadese S.p.A. offers the most extensive and most prestigious line of bituminous shingles available on the world market. Our product lines16 models in more than 52 colorsare characterized by their wide range of application, high performance, large variety of shades and colors, and versions available in our metal line. Such superior quality is the result of the continuous innovation that Tegola Canadese has implemented since its founding in 1977.

Tegola Canadese's products are capable of satisfying the most diverse design needs and of guaranteeing weather resistance, durability, low maintenance, ease and speed of installation, and high aesthetic value.

The quality of Tegola Canadese products is the result of an exclusive manufacturing process that employs natural raw materials, traditionally used in roofing, with excellent qualities.

The careful controls to which raw materials and production processes are subjected allow us to maintain a high level of quality in our roofing products.

Tegola Canadese shingles are a safe and versatile product, within our wide range of roofing products, and are especially appreciated wherever particularly aesthetic considerations exist or where there are special requirements related to the unusual slope or shape of the roof.

BITUMINOUS SHINGLE ROOFING

Tegola Canadese S.p.A.'s research efforts have contributed to the development of a product capable of satisfying the most diverse design needs and guaranteeing weather resistance, durability, low maintenance, ease and speed of installation, and high aesthetic value.

Characteristics such as these depend upon the quality of production (ISO 9001 and ISO 14001) but especially upon the raw materials used in the production of our bituminous shingles. In addition to their high level of quality, Tegola Canadese products increase the value of the entire roof bedding.

In general, the shingle's bearing structurethe part that is not seen but which characterizes the product and gives it its impermeabilityis made of a fiberglass support and of "Tia-Juana" bitumen. In specific:

Fig.21

- **Fiberglass**

The fiberglass used in the production of bituminous shingles (weight=125 g/m2), is the basic support and confers dimensional stability, nailability, and mechanical resistance (Fig. 21).

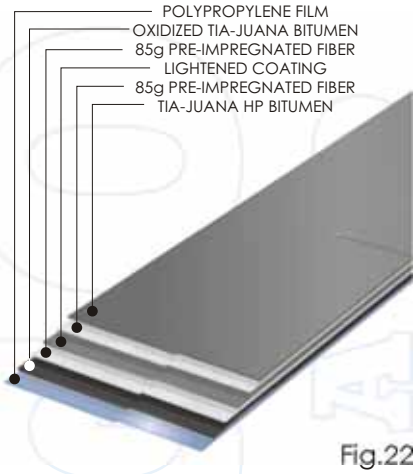


Fig.22

- **Bitumen**

For the production of our shingles, we exclusively use natural "Tia-Juana" bitumen produced in Venezuela. This bitumen has a branched molecular structure that offers significant stability in the presence of everyday heat conditions as well as resistance to UV rays, guaranteeing, as a result of these physical properties, increased impermeability and durability. Calcium carbonate is specially added in order to augment the rheological characteristics of the bitumen, absorbing more volatile substances which are then slowly released, increasing resistance to UV radiation.

Tegola Canadese's PRESTIGE models use a reinforced structure that gives the product improved mechanical properties due to its 5 mm thickness and to the use of a double fiberglass support. The bitumen we use, as always, is "Tia-Juana" from Venezuela treated with Tegola Canadese's exclusive technology (Fig. 22).

- **The upper surface**

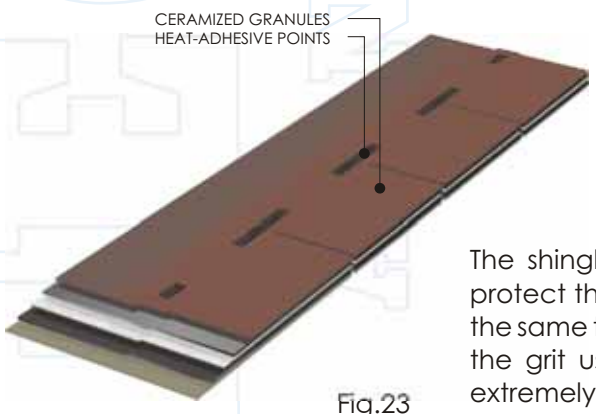


Fig.23

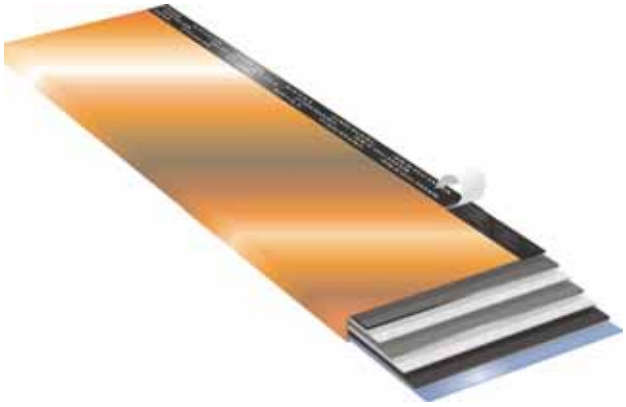
The upper surface of the shingle is composed either of ceramized granules (for Shingles Line models) or of metal laminate (for Metal Line models). Their function is double: technical, on the one hand (protection of the surface from UV rays), and aesthetic on the other. Tegola Canadese's product line16 models in more than 52 colorsallows the designer to express himself fully and to bring out the best in his architectural approach.

The shingles in **the Shingles Line** (Fig. 23) employ ceramized granules to protect the underlying bituminous layers from the action of UV rays and, at the same time, to give them their colour. Tegola Canadese directly produces the grit used in the production of its shingles, using grains of basalt, an extremely hard stone that offers high weatherability and which is UV opaque. The grit is colored using a high-temperature (greater than 650 °C) ceramic and glazing process with the addition of inorganic coloring agents to

guarantee absolute color stability over time.
The Metal Line (Fig. 24-25-26) is a line of shingles with laminated surfaces. The laminate may be of 99.7%-pure copper, and is available in three varieties:

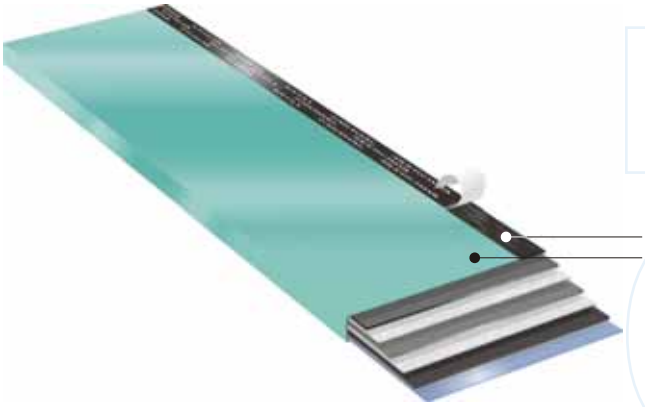
- natural copper (which is subject to normal oxidation)

- copper protected with transparent "Star" finish



Natural and Star copper
Fig.24

- antiqued ("Antique")



Antique Copper
Fig.25

Model ZT in zinc-titanium alloy

ZT Zinc Titanium
Fig.26

This product line guarantees shingles that are stable, strong, and flexible and is recommended for roofing of every kind, whether in historical centers or in the countryside. The Metal Line is in harmony with history and with the physical environment, and the traditional greenish coloration of the self-protective patina caused by oxidation (formed when copper comes into contact with the elements) or the silvery highlights of zinc-titanium lend good taste and "prestige" to roofing.

Fig.23

For complete product information, please consult our website (www.tegolacanadese.com) or contact us at: info@tegolacanadese.com.

APPLICATION METHODS

The Tegola Canadese laying surface may be composed of different support materials: concrete or mixed reinforced concrete and hollow clay infill block, plywood, tongue-and-groove planking, insulating materials, or sheet metal. What is important is to determine the application technology for the product in question and to make certain that the laying surface for the shingles is completely flat, in a good state of preservation (if it is not new), and stable over time.

The bituminous shingles are applied onto the nailable laying surface and are attached with large-head annular-ring nails (Fig. 27), between 25 and 35 mm in length, depending upon the thickness of the roof covering. On surfaces that cannot be nailed, the bituminous membrane is used as an adhesive between the laying surface and the shingles (Fig. 28). The waterproof membrane is made to adhere completely to the laying surface with a gas torch. The shingle is then torch-applied, heating the bitumen of the waterproof membrane on the underside face of the "tail" of the shingle. The bituminous membrane, modified with elastoplastomeric polymers, has a high softening point and should assure an effective bond both with the support and with shingles and guarantees stability over time. It should therefore have good adhesion, traction resistance, elasticity, and a bitumen covering compatible with that used on Tegola Canadese shingles. The Tegola Canadese bituminous membrane complies fully with these requirements.

The use of these two methods makes it possible to apply Tegola Canadese even on slopes that are concave or convex and on cupolas whose slope may vary from 2° to 87°. Because we are speaking of slopes, we want to remind the reader that the use of bituminous shingles creates a discontinuous roof covering, whose impermeability comes from the overlapping of elements and from the slope of the surface. Thus, for any given slope (always greater than 15° or 25%, depending upon the model of shingle; consult Appendix 1, p. 59) the roof covering becomes impermeable simply because of the overlapping of its elements. In slopes less than 15° or 25%, meanwhile, and independent of the type of support used, shingles must be applied with the use of a bituminous membrane as a waterproof underlay.

Fig.27

Fig.28